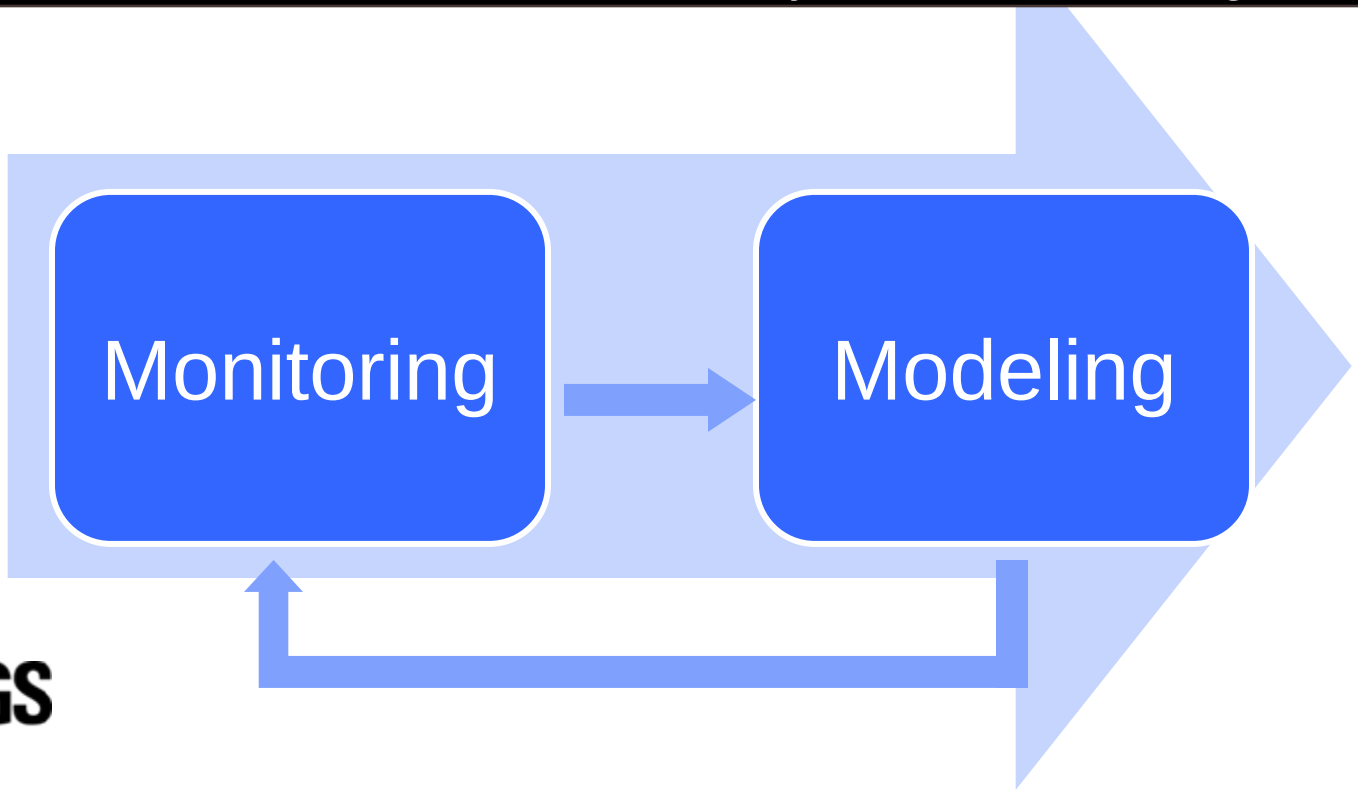
Moving from Monitoring to Modeling: Regional Assessments of Nutrient Sources, Transport, and Delivery to Streams and Coastal Areas

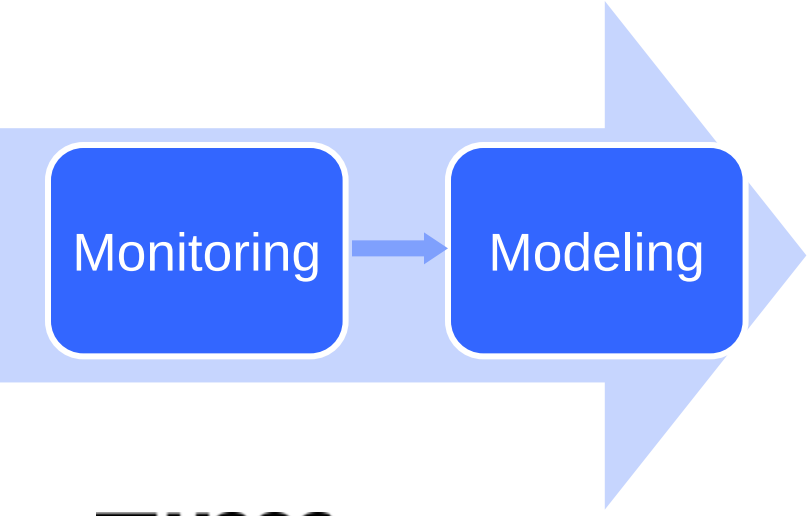
Mike Woodside
USGS National Water-Quality Assessment Program



USGS

Regional assessments of nutrient sources and transport

Objective: **Build understanding of how human activities and natural features influence nutrient conditions in streams**



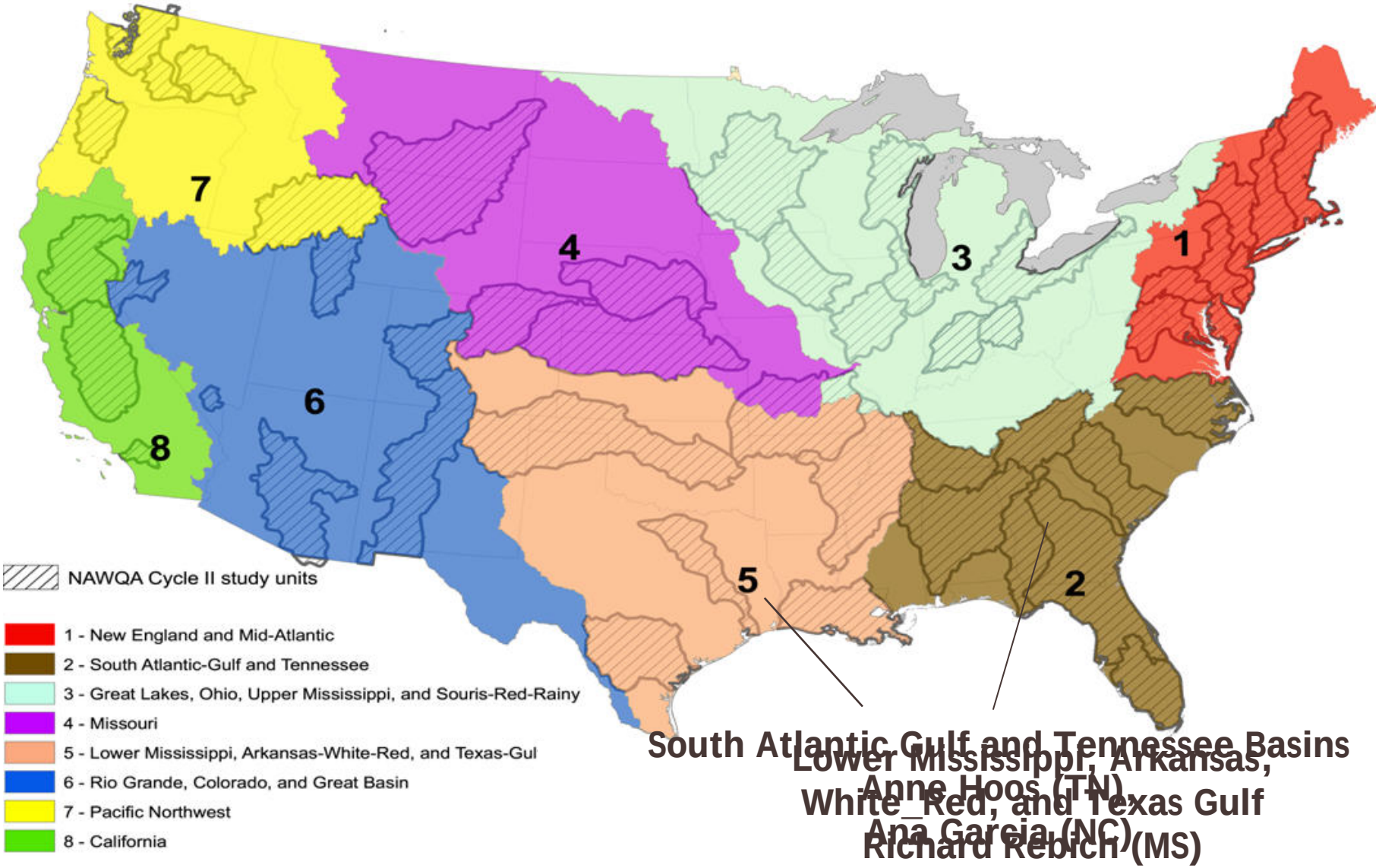
Approach

Integrate monitoring data and watershed data within a regional model framework

Integrate USGS data with data from other Federal and state agencies

USGS

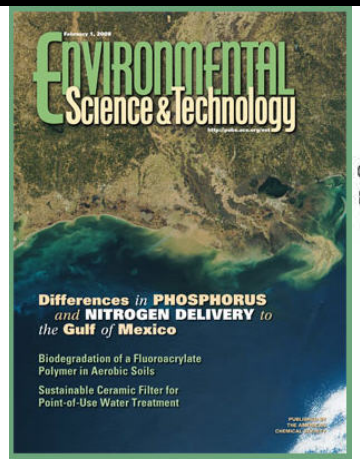
Regional nutrient models in development for regions 1 – 5 and 7

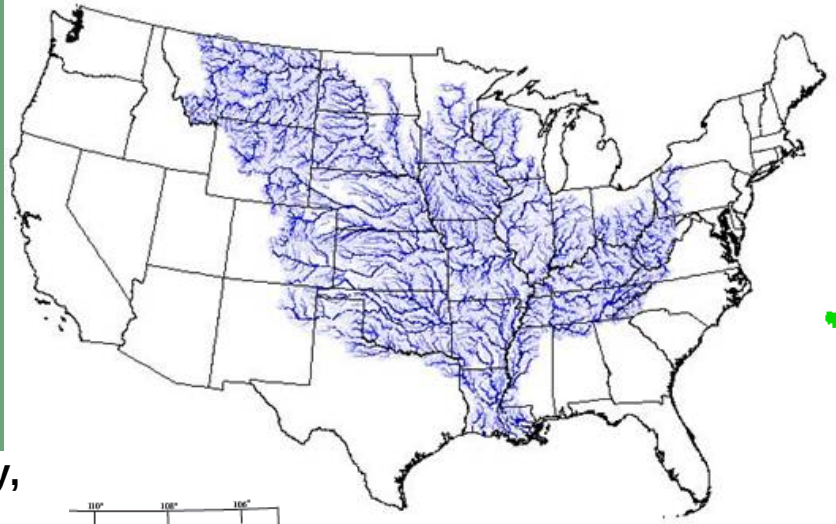


South Atlantic Gulf and Tennessee Basins
Anne Hoos (TN)
Ana Garcia (NC)

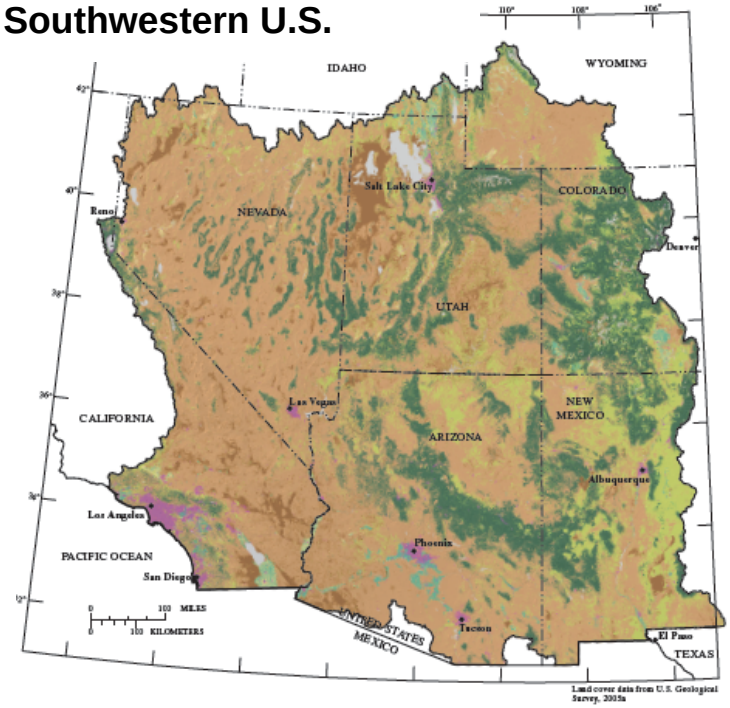
Lower Mississippi, Arkansas, White_Red, and Texas Gulf
Richard Rebich (MS)

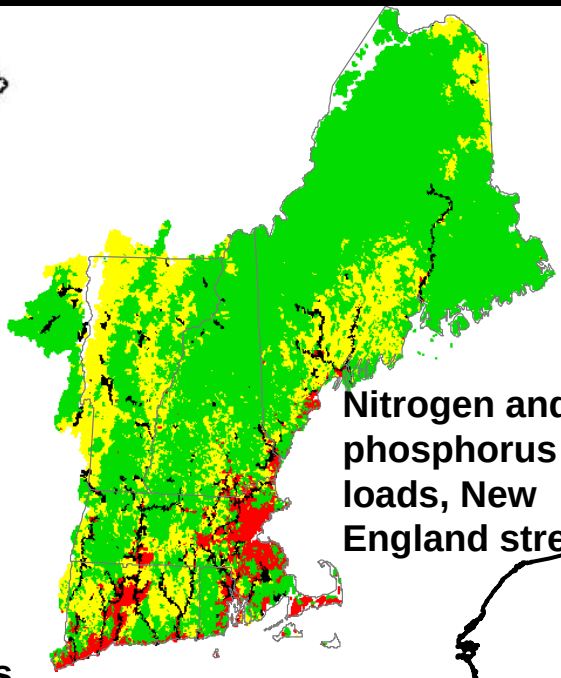
National and regional-scale SPARROW models





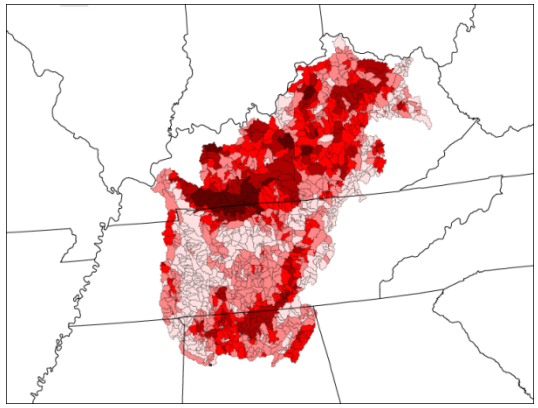
Source areas of salinity, Southwestern U.S.



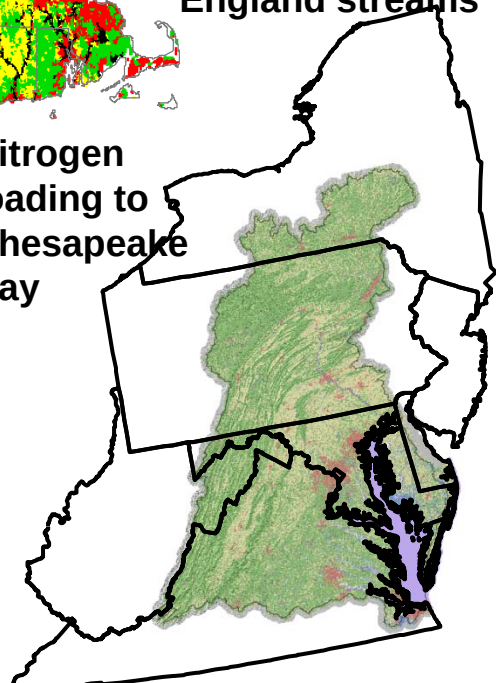


Nitrogen and phosphorus loads, New England streams

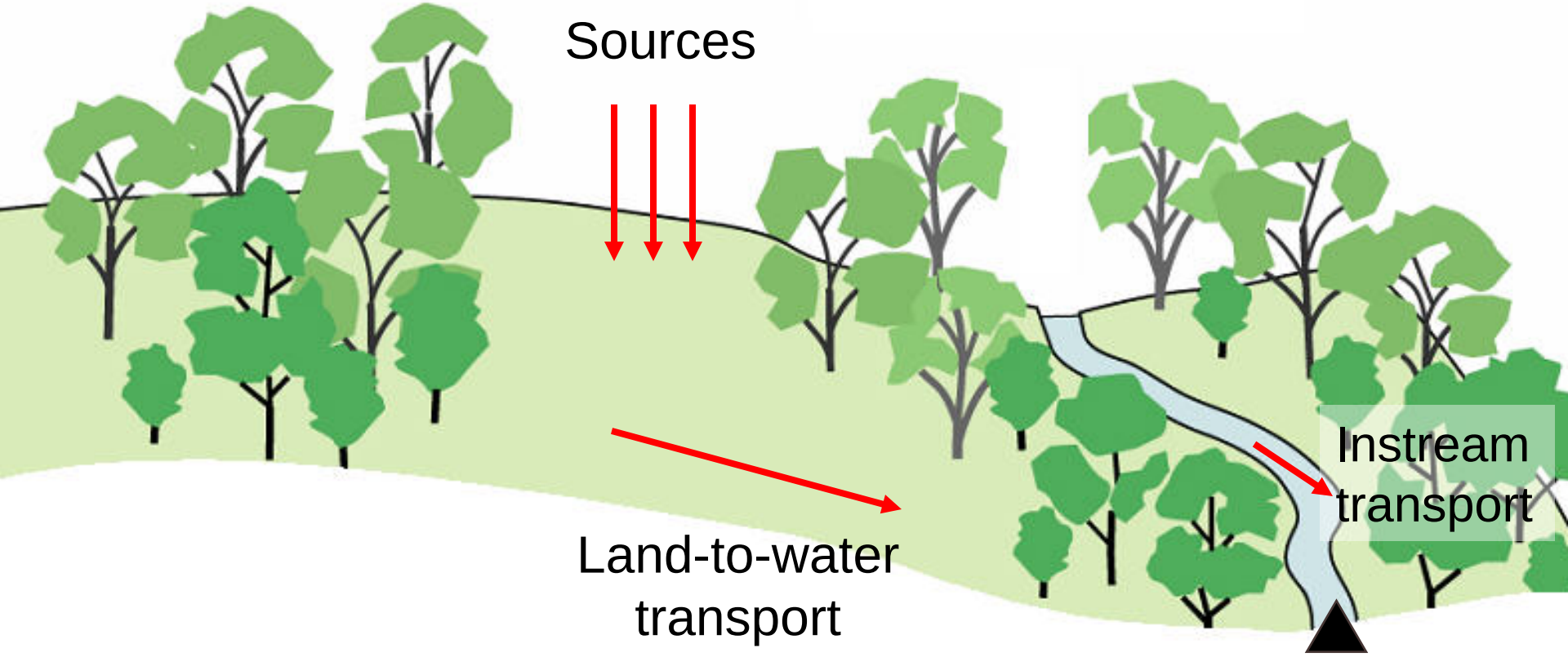
Nitrogen and phosphorus loads, Interior Low Plateau



Nitrogen loading to Chesapeake Bay



SPARROW* Model Concept

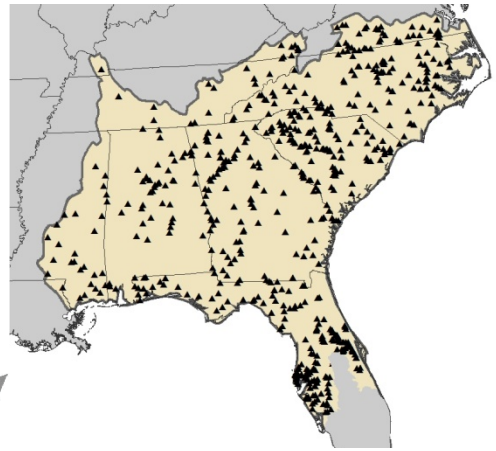


***SPA**tially **R**eferenced **R**egression **O**n **W**atershed Attributes**

USGS

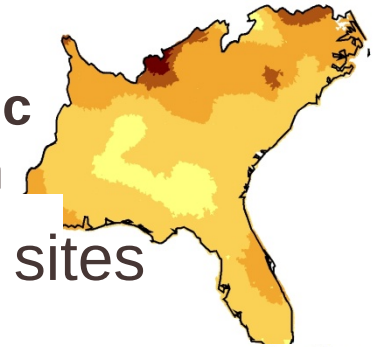
SPARROW Model Framework

Monitoring Data
782 Sites



Spatial Data Layers

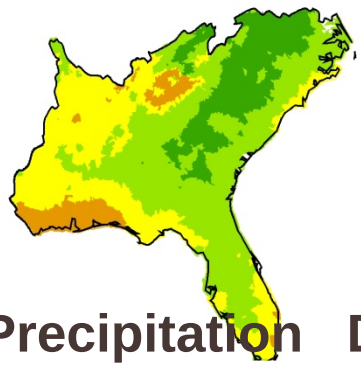
Atmospheric deposition



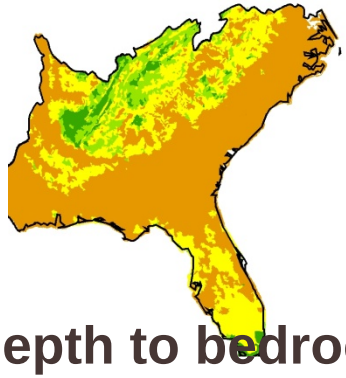
NADP – 33 sites

Fertilizer applied to farmland

2002 County Est.



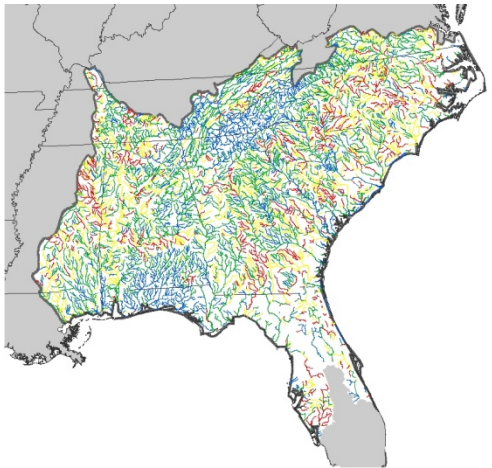
Precipitation



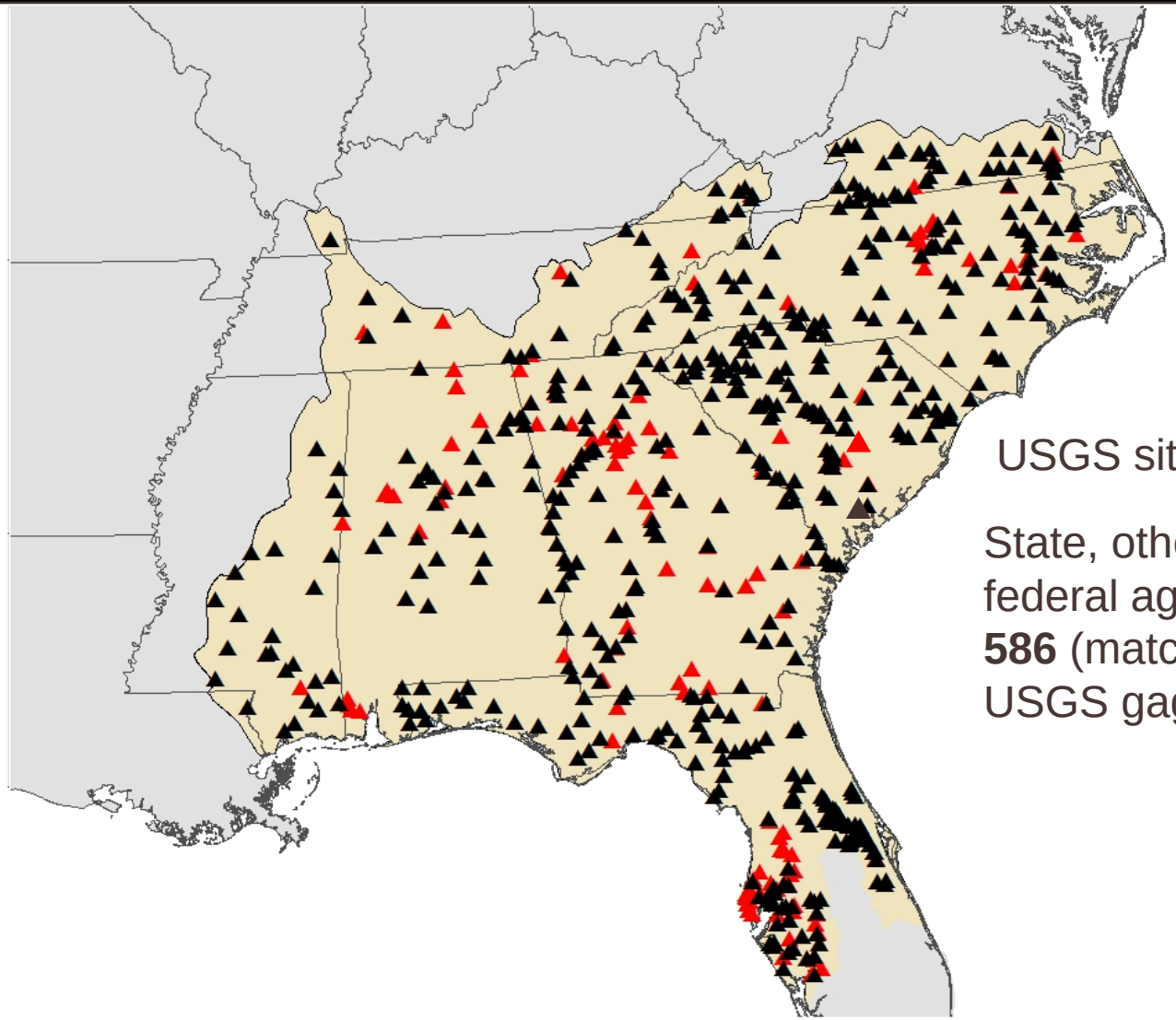
Depth to bedrock

STATSGO

Model Predictions
8,092 Stream Reaches



Estimates of mean annual nutrient load at 782 sites for 2002



USGS sites: **196**

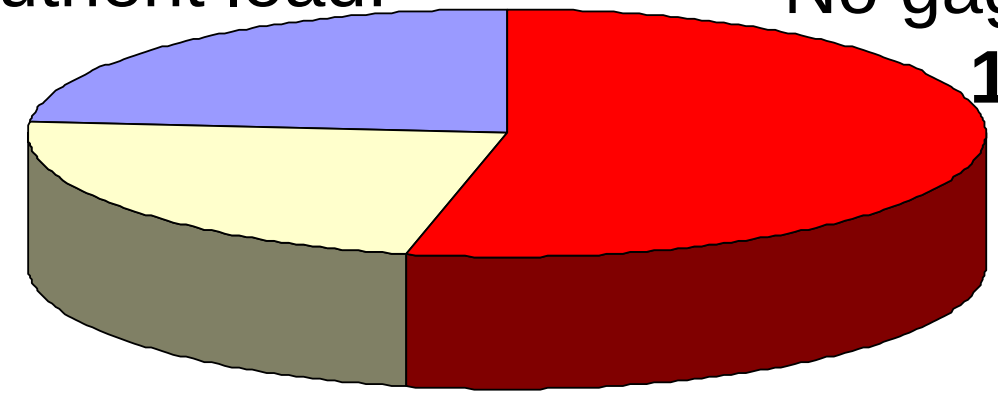
State, other federal agencies: **586** (matched to USGS gage)

USGS

“Shakedown” of monitoring data for load estimation

- Nutrient data retained for 21,500 stream sites
- 3,400 sites with sufficient record (Quarterly with minimum of 20 samples)

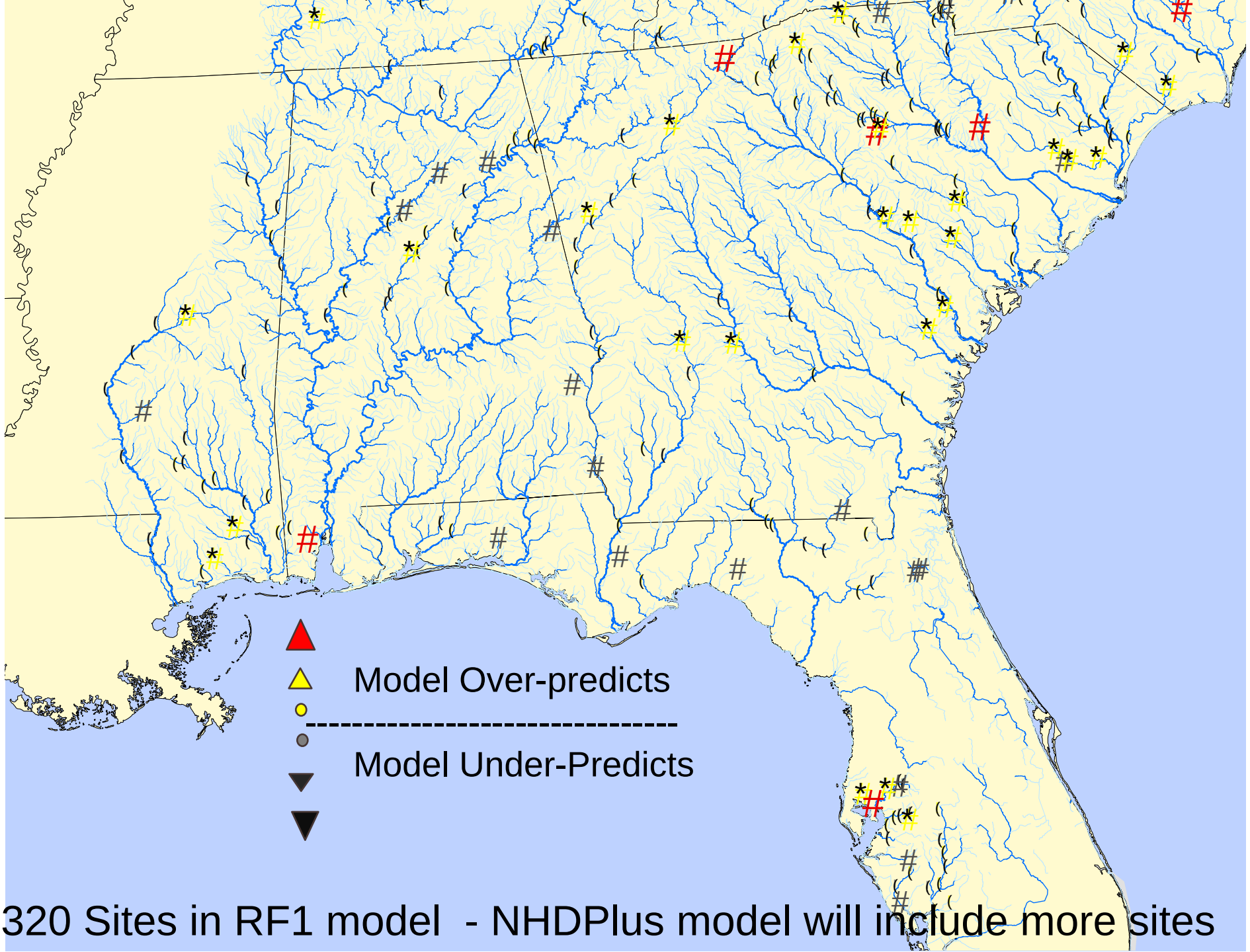
Estimate nutrient load: **782** sites



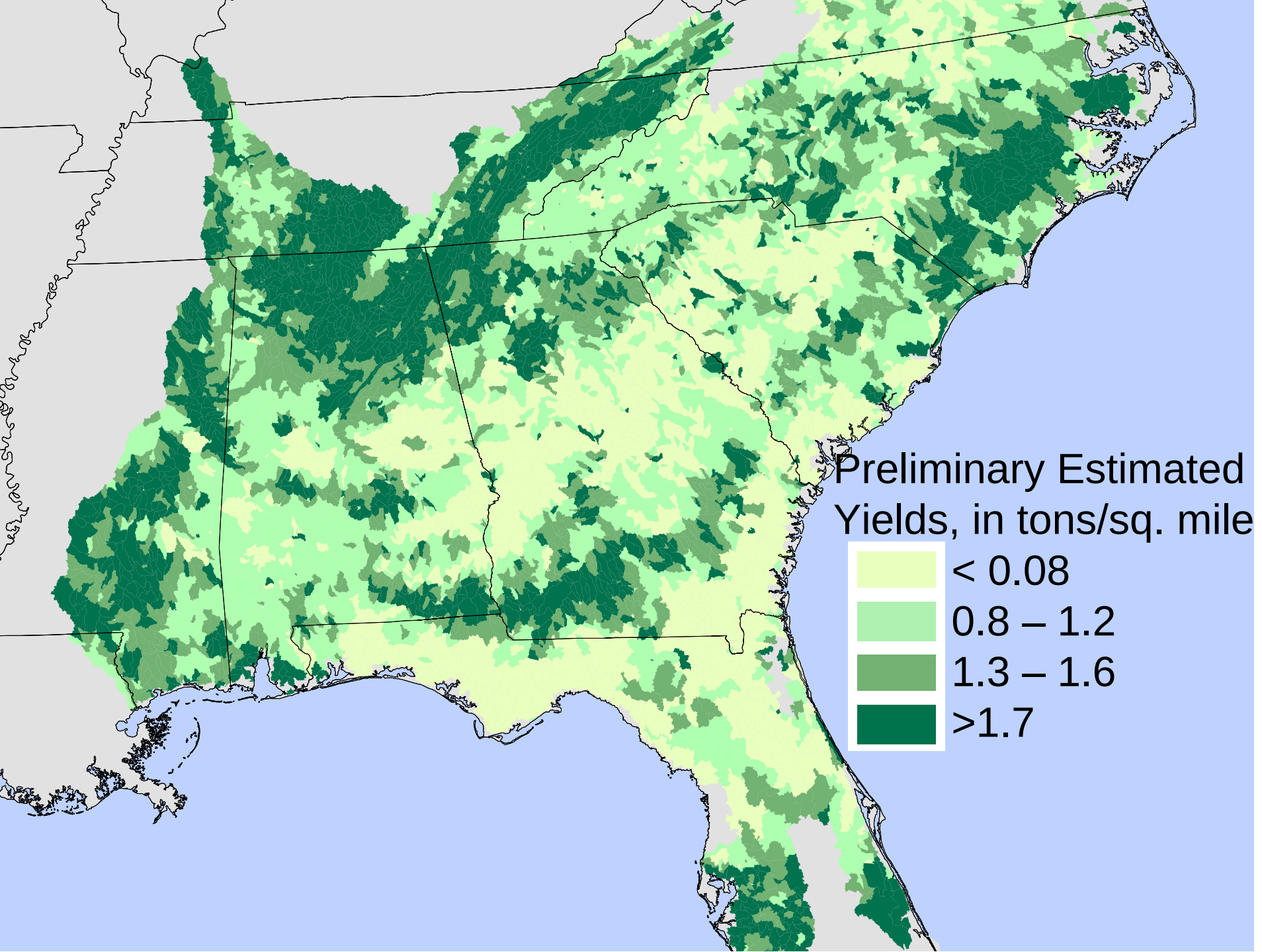
No gage nearby: **1824** sites

Insufficient streamflow record: **794** sites

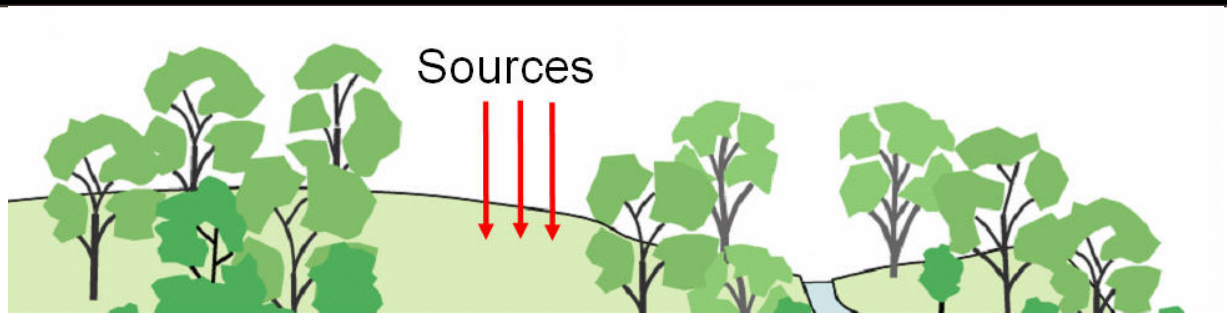
USGS



320 Sites in RF1 model - NHDPlus model will include more sites


Preliminary Estimated Yields, in tons/sq. mile
< 0.08
0.8 – 1.2
1.3 – 1.6
>1.7

Sources accounting for instream nitrogen load



% contribution to instream load, average for region

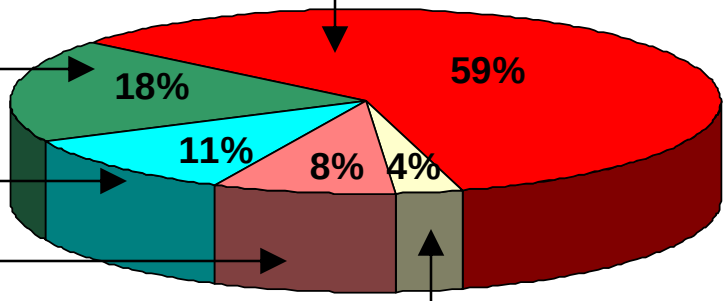
Atmospheric deposition

Fertilizer applied to farmland

Animal waste

Impervious surface area

Point-source discharge



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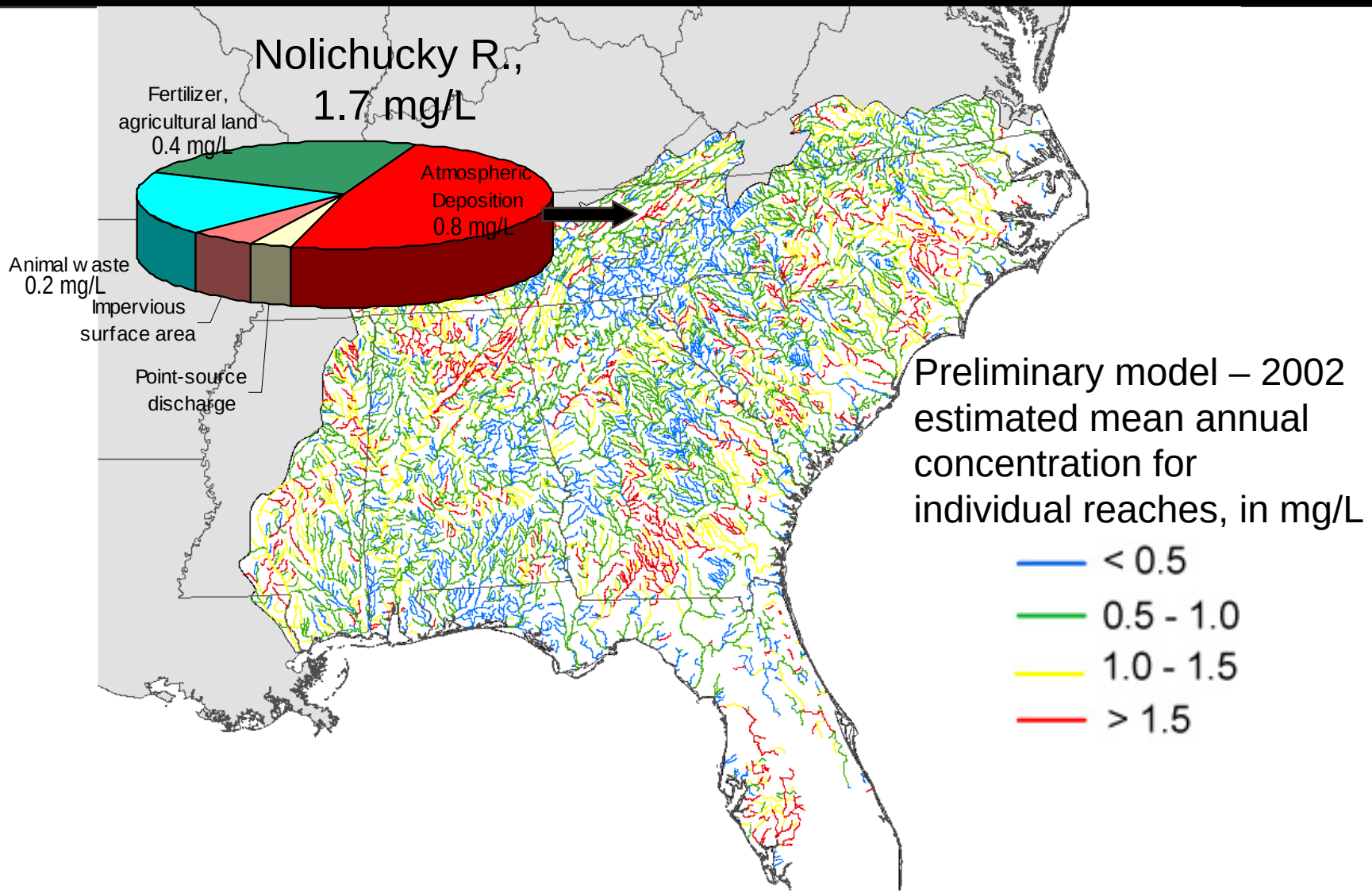
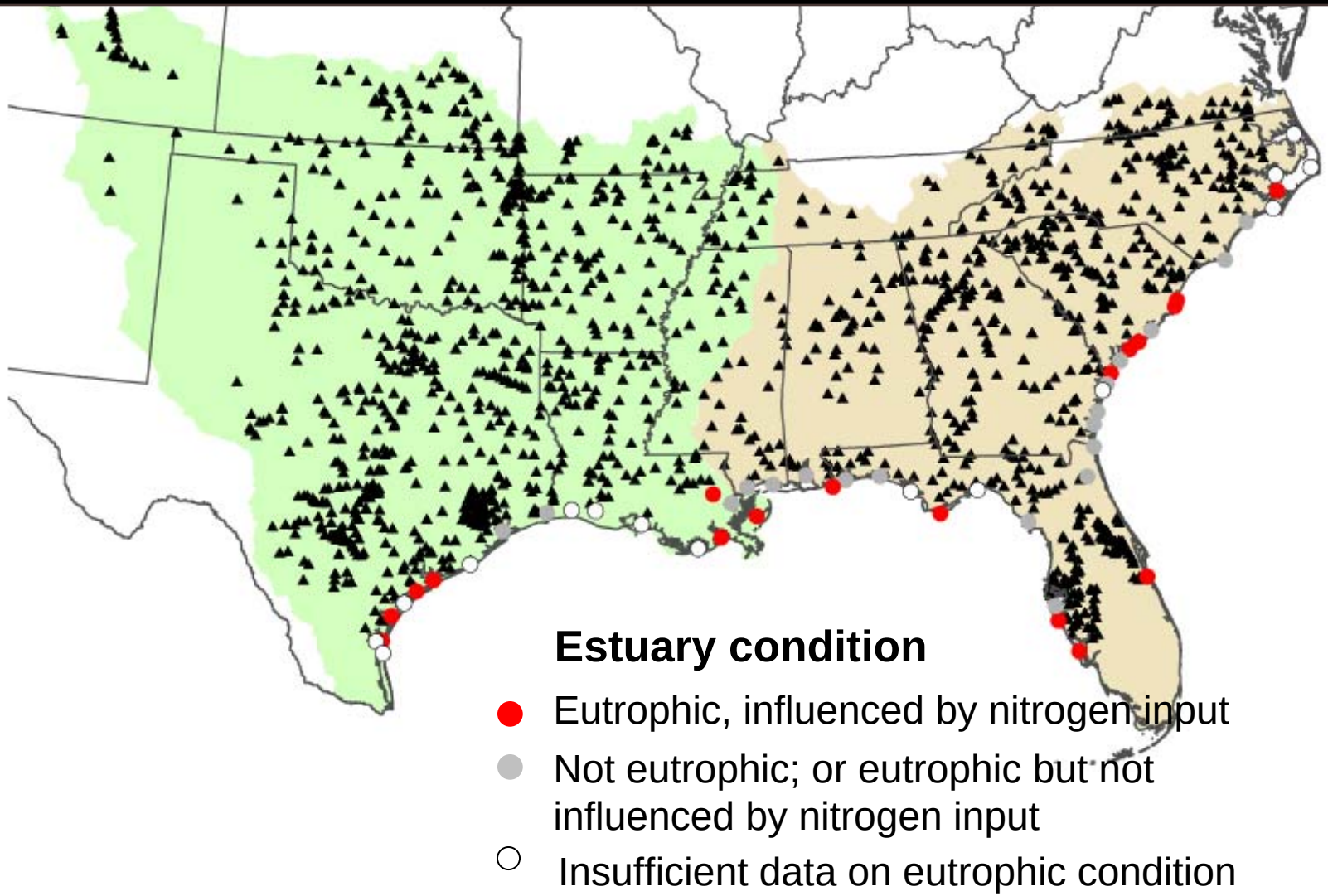
SPARROW model results support resource management decisions

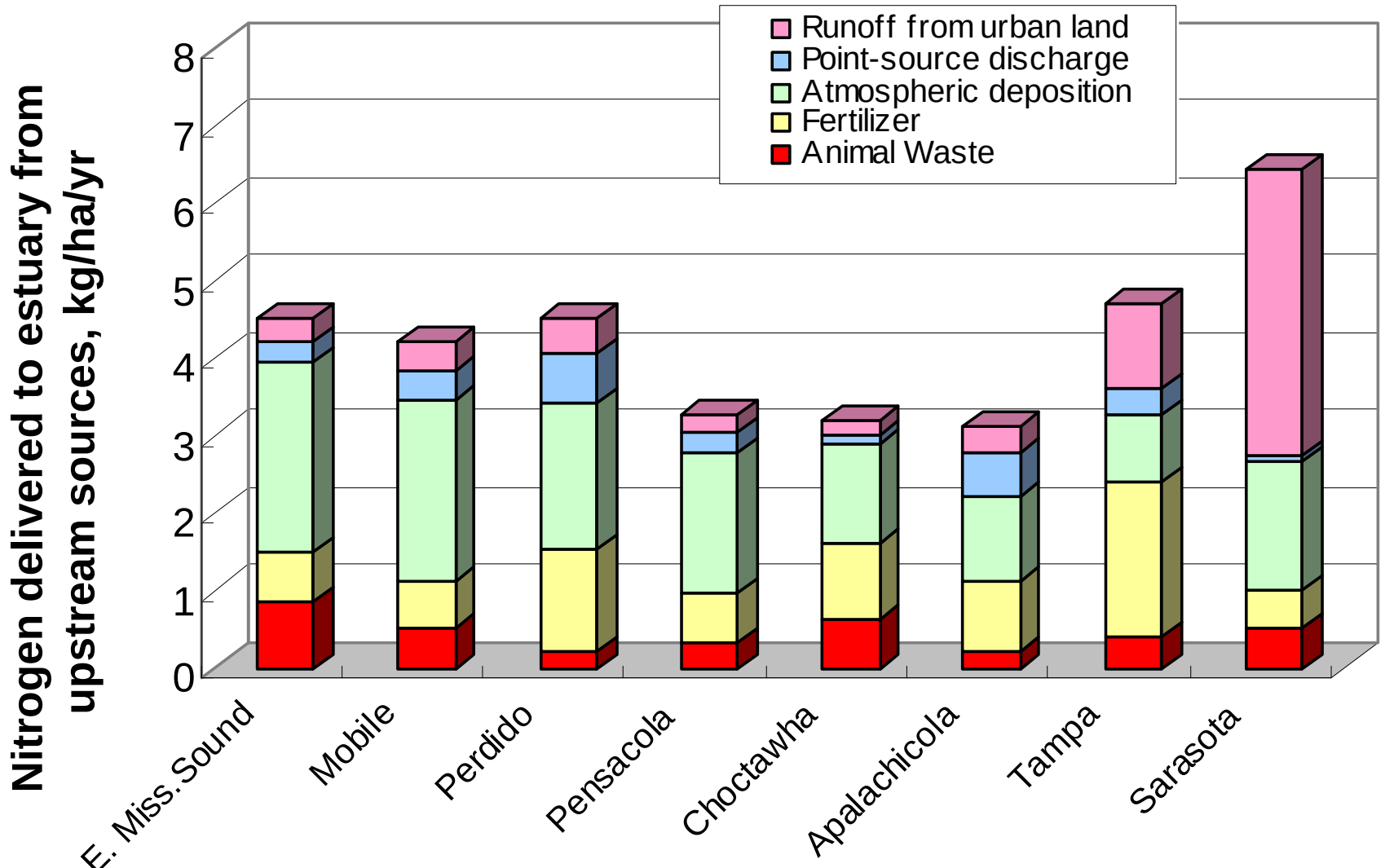


Coastal areas sensitive to nitrogen input



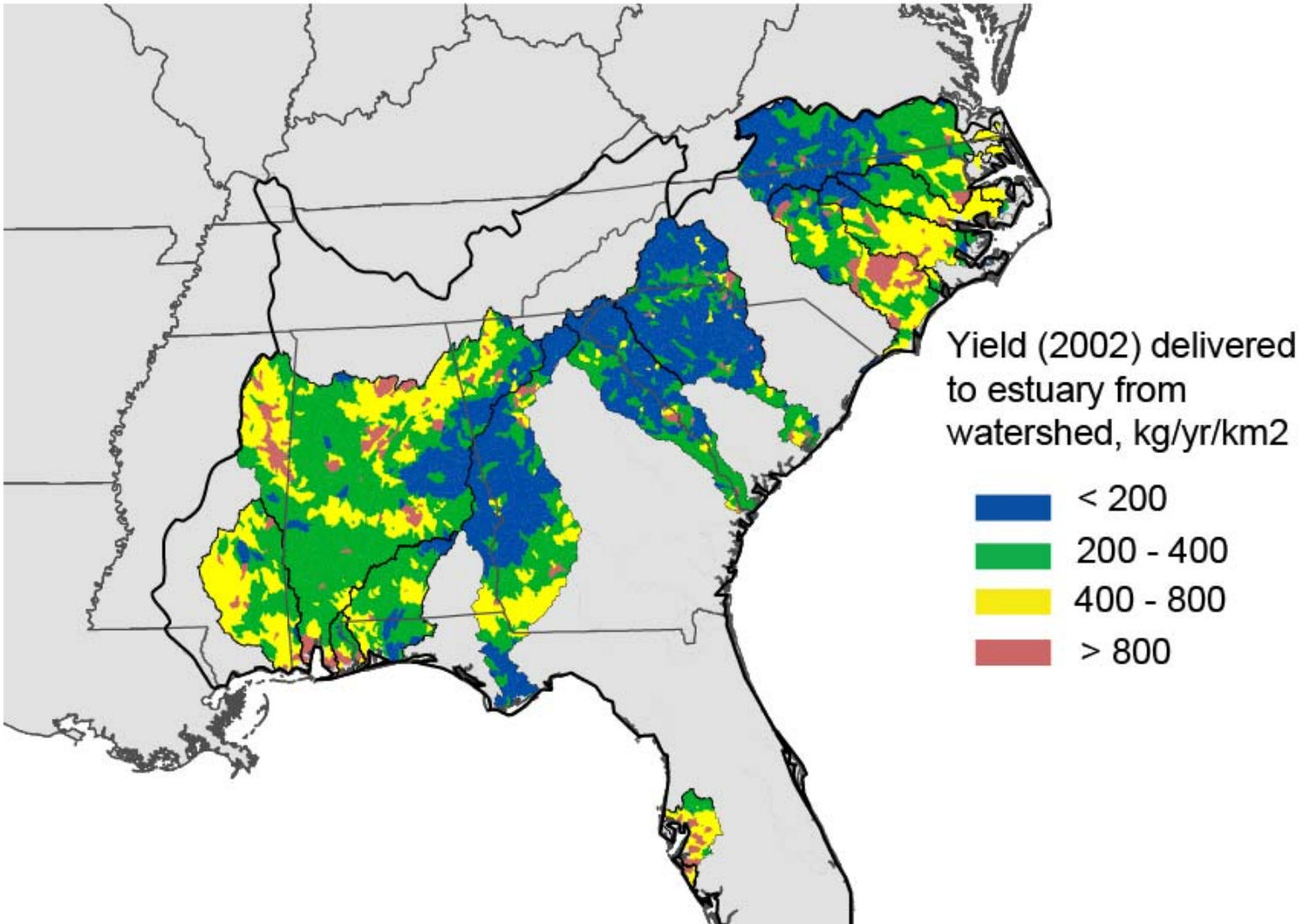
Source: National Estuarine Eutrophication Assessment, 2007

Preliminary model-estimated source shares of load delivered to estuaries

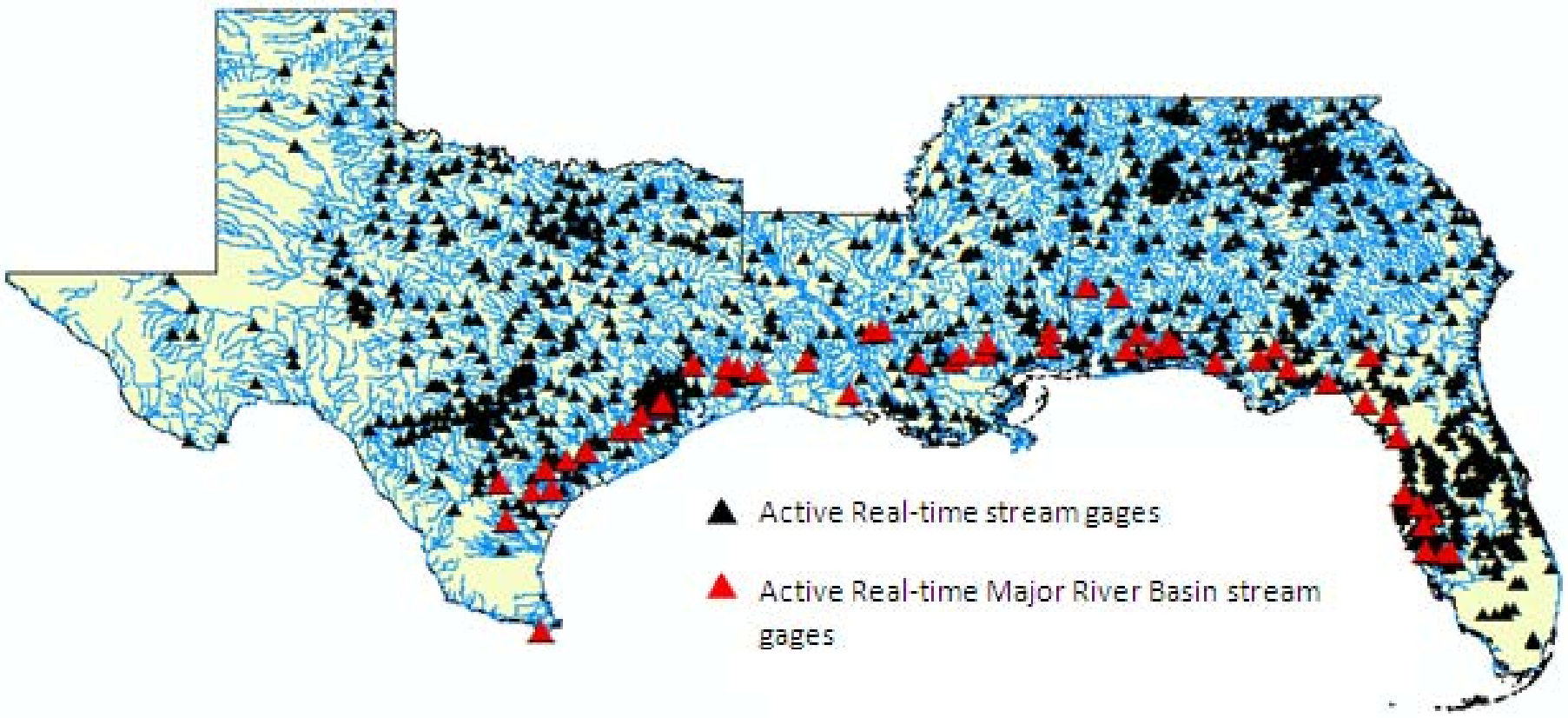


USGS Nitrogen-sensitive estuaries, eastern Gulf of Mexico

Preliminary model results indicate areas contributing greatest amounts of nitrogen to estuary



Streamflow Data Are Available at 48 of 54 Major Streams Draining to Gulf of Mexico



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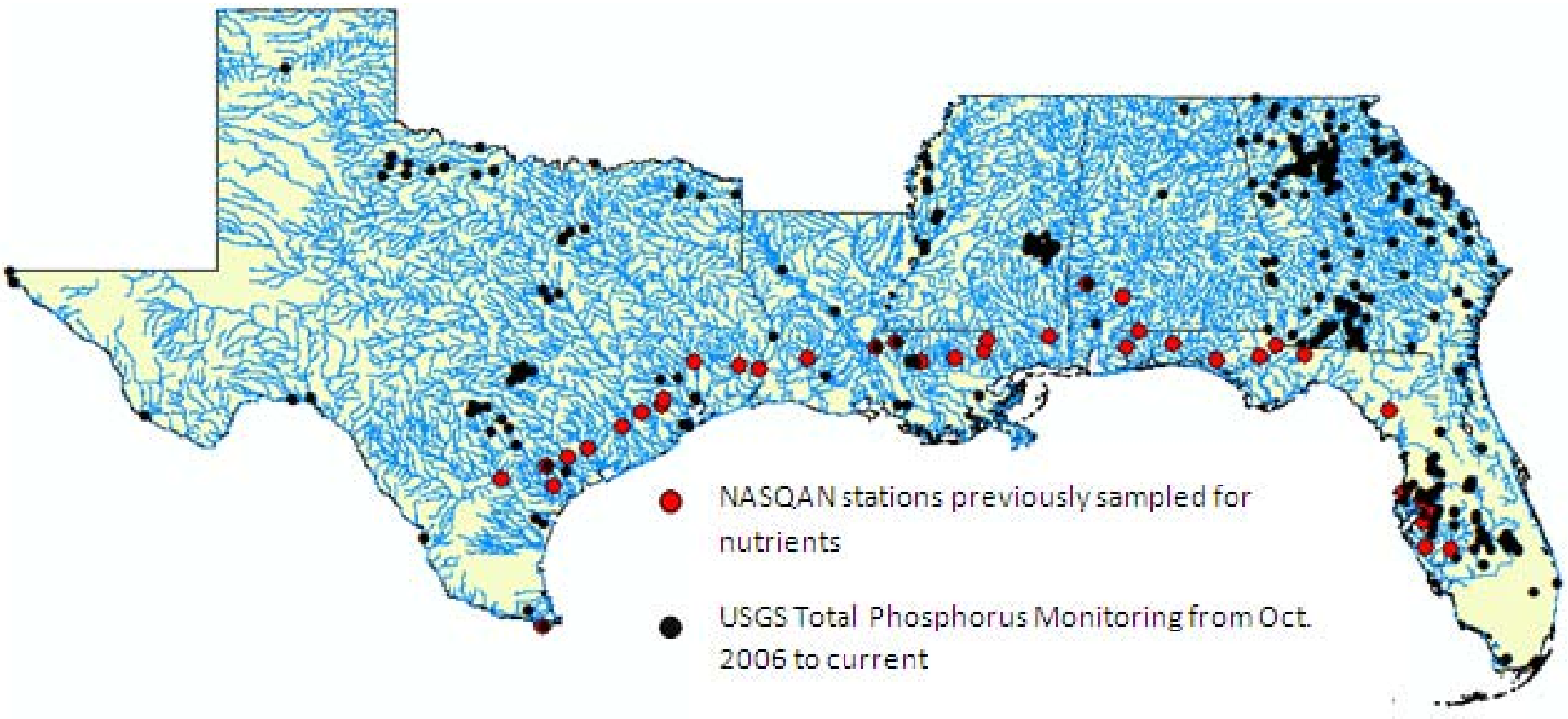
Significant Cuts to USGS NASQAN Program Reduced the Number of Coastal Nutrient Monitoring Sites



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Methods for Targeting Nutrient Reductions in the Mississippi River Basin Through the Use of the SPARROW Model

By

Dale M. Robertson and David A. Saad,
Wisconsin WSC

Richard B. Alexander and Gregory E. Schwarz,
National Center, Reston, VA

Dennis M. Heisey,
USGS. Wildlife Health Center, Wisconsin

USGS

Summary

1. SPARROW model provides improved understanding of the factors that control nitrogen transport on land and in streams

2. Model results can support nutrient-management strategies

3. Model input and results provide framework for additional investigations

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Products

- **Trends/Loads Report for South Central US**
- **Online data report documenting model input data sets**
- **Journal Articles on Nitrogen and Phosphorus Models—Also developing sparrow decision support tool**

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Contact Information

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http://water.usgs.gov/nawqa/sparrow/